January 11, 1963

Professor John R. Platt
Department of Physics
University of Chicago
Chicago 37, Illinois

Dear John:

I was most interested to have your letter of December 17; naturally, what comes to mind most immediately is what we might do to bring you here where we can have the most immediate benefit of your company. It seems to me that you are probably just as puzzled about framing exactly what you want to do, as I am in trying to see what we might do to match it. In these circumstances, it would be ideal if you could manage to be out here for some shorter period of time with no overt commitment. During such a time, we could get to know one another better (we = Stanford, you and me) to look for the answers to a non-trivial organizational problem.

As it happens (and Elliott Levinthal may already have briefed you on this) our exobiology responsibilities have led us to wonder if we could frame a theory, or at least some better system, of methodology for biochemical analysis. I hardly know what to call this, instrumentology or metronomy. Briefly, I am asking for a better deductive framework to help in making decisions as to the choice of measurement techniques that we might use in the detection of planetary life. At the moment, we rely on an immense pile of intuitive and empirical insight in such choices, and every day brings some new procedure to think about as an alternative to what we have already been discussing. Our approach to this problem is to try to devise better principles for the classification of presently existing or thought-of instruments for analytical measurement. At least it should be better than by the alphabetic sequence of trivial names, or by the date of the suggestion or development, or the dollar cost of the existing machines, which are the (implicit) systems of classification we now use. A systematic approach would, of course, include all of the fundamental principles of physics, and should give us some assurance that every possible machine (unless it involved an unstated physical principle) was in some fashion already part of the system. Most actual instruments are rather complicated, but hopefully we could find some generalizations that could help us manage the complexities without having to investigate every possible compounding of elementary parts as a special case. Needless to say, such a system would also be invaluable in generating new instruments and optimal solutions to existing problems.

The basic idea is to start with the simplest case: one particle in a black box, with an accompanying list of specifications. How can we identify such a particle (enumerate the specifications)? In general, by introducing another particle or beam (with known input specifications): the operation

(Input probe) . (initial particle) ⟶ (Output probe) . (present particle)

$P_{ii}P_{ji}P_{ki}\cdots$ $X_{ii}X_{ji}X_{ki}\cdots$ $P_{io}P_{jo}P_{ko}$ $X_{io}X_{jo}X_{ko}\cdots$

This operation is generally iterated, through a series of transducers, to obtain a useful signal of the alteration of some one or more of the p's or x's. In this dichotomy we already see a major point of classification; when x_i is a positional coordinate we have the systems in which the transport of the proband is crucial -- chromatography, sedimentation, mass spectrometry -- which then usually requires a further probe for the sensitive detection of a displaced mass (often not sensitive to composition).

Well we have gotten a bit further than this, enough mainly to show that we have an enormous and subtle problem on our hands. Being somewhat surprised that this kind of perception analysis does not seem to have been systematized, I am hopeful that we could striaghten out a lot of disorderly thinking by the attempt; and certainly a lot of new(-to-us) ideas about analytical approaches have come out already, and should continue to do so. I would like to elicit your interest in helping us, at the least, better understand the nature and the possible utility of the problem; even better, to get on with it. It should take no more than a total knowledge of existing physics to encompass the full range of elementary transformations, and it would be already useful if this merely generated a computable code to describe and tabulate these processes. The more important problem is how to proceed from the one-particle, one probe case, and how best to introduce more complicated probes, e.g. analytical reagents. (These can hardly be cladsified so systematically as elementary particles or fields, but some order is better than total chaos).

I can hardly think of anyone whose previous background (and, may I hope, present interests) was better suited for commenting on this problem than yourself. In fact, you can hardly help but have been thinking along these lines yourself, whether or not you have come out with a systematic projection of it. Can we interest you in coming out here for an interval, this spring, the sooner the better. Would a month be possible? We can be fairly relaxed about financial arrangements; the simplest thing to say is we will take over your salary for the interval (if there is any reason to shiftthis from U/C) with a reasonable further accomodation for the travel and extra living costs of a temporary domicile.

Another very different sort of possibility you might want to think of is a fellowship at the Center for Behavior Studies (a Ford F'n Supported activity located on campus.) If you don't already know all about this and might be interested, let me know.

Sincerely,

Joshua Lederberg